

## CLAIMS

1. A composition for etching a polymer substrate comprising a dihydric alcohol having from two to five carbon atoms, a hydroxide compound selected from the group consisting of lithium hydroxide, sodium hydroxide, potassium hydroxide, calcium hydroxide, barium hydroxide, strontium hydroxide and mixtures thereof, and water.

2. The composition of claim 1, wherein said dihydric alcohol comprises glycol and said hydroxide comprises potassium hydroxide.

3. The composition of claim 1, further including an inhibitor selected from the group consisting of NaF,  $\text{CH}_3\text{COONa}$ ,  $\text{CH}_3\text{COOK}$ ,  $\text{K}_2\text{CO}_3$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{K}_3\text{PO}_4$ , hexamethylene tetramine, and mixtures thereof.

4. The composition of claim 1 wherein said dihydric alcohol and said water are present in a ratio of from about 0.5:1 to about 8.5:1.

5. The composition of claim 4, wherein said hydroxide compound is present in an amount of from about 40 to about 80 grams per 100 ml of dihydric alcohol and water solution.

6. The composition of claim 1, wherein said hydroxide compound is present in an amount of from about 40 to about 80 grams per 100 ml of dihydric alcohol and water solution.

7. The composition of claim 1, wherein said water comprises deionized water.

8. A composition for etching a polymer substrate comprising glycol, potassium hydroxide and deionized water, wherein said glycol and said water are present in a ratio of from about 0.5:1 to about 8.5:1 and said potassium hydroxide is present in an amount of from about 40 to about 80 grams per 100 ml of glycol and water solution.

9. The composition of claim 8, further including an inhibitor selected from the group consisting of NaF,  $\text{CH}_3\text{COONa}$ ,  $\text{CH}_3\text{COOK}$ ,  $\text{K}_2\text{CO}_3$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{K}_3\text{PO}_4$ , hexamethylene tetramine, and mixtures thereof.

10. A method for etching a polymer substrate to form a via, said method comprising exposing a portion of said substrate to an etchant composition comprising a dihydric alcohol having from two to five carbon atoms, a hydroxide compound selected from the group consisting of lithium hydroxide, sodium hydroxide, potassium hydroxide, calcium hydroxide, barium hydroxide, strontium hydroxide and mixtures thereof, and water.

11. The method of claim 10, wherein said dihydric alcohol comprises glycol and said hydroxide comprises potassium hydroxide.

12. The method of claim 10, wherein said dihydric alcohol and said water are present in a ratio of from about 0.5:1 to about 8.5:1.

13. The method of claim 12, wherein said hydroxide compound is present in an amount of from about 40 to about 80 grams per 100 ml of dihydric alcohol and water solution.

14. The method of claim 10, wherein said hydroxide compound is present in an amount of from about 40 to about 80 grams per 100 ml of dihydric alcohol and water solution.

15. The method of claim 10, wherein said water comprises deionized water.

16. The method of claim 10, wherein said composition further includes an inhibitor selected from the group consisting of NaF,  $\text{CH}_3\text{COONa}$ ,  $\text{CH}_3\text{COOK}$ ,  $\text{K}_2\text{CO}_3$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{K}_3\text{PO}_4$ , hexamethylene tetramine, and mixtures thereof.

17. The method of claim 10, further including soaking said substrate before the exposing step in water at a temperature of from about 160° to about 180°F.

18. The method of claim 10, wherein said substrate is exposed to said etchant composition at a temperature of from about 170° to about 230°F.

19. The method of claim 10, wherein said substrate is exposed to said etch composition at a temperature of from about 180° to about 210°F.

20. The method of claim 10, further including cleaning said substrate after said exposing step with water at a temperature in the range of from about 160° to about 180°F.

21. The method of claim 10, further including exposing said substrate to said etchant composition until a portion of said composition covering said via changes color.

22. The method of claim 21, wherein said color comprises red.

23. The method of claim 10, wherein said via has a diameter of about 100 microns or less.

24. The method of claim 10, wherein said substrate comprises polyimide.

25. A method for etching a via in a polyimide substrate comprising exposing a portion of said substrate to an etchant composition at a temperature in the range of from about 170° to about 230°F, said composition comprising glycol, potassium hydroxide and deionized water, wherein said glycol and said water are present in a ratio of from about 0.5:1 to about 8.5:1 and said potassium hydroxide is present in an amount of from about 40 to about 80 grams per 100 ml of glycol and water solution, and continuing said exposing step until a portion of said composition covering said via changes color.

26. The method of claim 25, wherein said temperature is in the range of from about 180° to about 210°F.

27. The method of claim 25, wherein said via has a diameter of about 100 microns or less.

28. The method of claim 25, wherein said color comprises red.

29. The method of claim 25, further including cleaning said substrate after said exposing step with water at a temperature in the range of from about 160° to about 180°F.

30. The method of claim 25, further including soaking said substrate before the exposing step in water at a temperature of from about 160° to about 180°F.

31. The composition of claim 1, wherein said composition has a boiling point in the range of from about 240°F to about 300°F.

32. The composition of claim 1, wherein said composition has a boiling point in the range of from about 260°F to about 280°F.

33. The composition of claim 8, wherein said composition has a boiling point in the range of from about 240°F to about 300°F.

34. The composition of claim 8, wherein said composition has a boiling point in the range of from about 260°F to about 280°F.

35. The composition of claim 1, wherein said substrate comprises a polyimide substrate.

36. The composition of claim 8, wherein said substrate comprises a polyimide substrate.

37. The method of claim 10, wherein said composition has a boiling point in the range of from about 240°F to about 300°F.

38. The method of claim 10, wherein said composition has a boiling point in the range of from about 260°F to about 280°F.

39. The method of claim 25, wherein said composition has a boiling point in the range of from about 240°F to about 300°F.

40. The method of claim 25, wherein said composition has a boiling point in the range of from about 260°F to about 280°F.

41. A polymer substrate having at least one via formed therein, said via formed by exposing a portion of said substrate to an etchant composition comprising a dihydric alcohol having from two to five carbon atoms, a hydroxide compound selected from the group consisting of lithium hydroxide, sodium hydroxide, potassium hydroxide, calcium hydroxide, barium hydroxide, strontium hydroxide and mixtures thereof, and water.

42. The substrate of claim 41, further including a plurality of vias formed within said substrate.

43. The substrate of claim 42, wherein at least one of said vias has a diameter of about 100 microns or less.

44. The substrate of claim 41, wherein said substrate comprises a polyimide substrate.

45. The substrate of claim 41, wherein said substrate includes opposing first and second surfaces, and a first metal layer overlying said first surface, said first metal layer including an opening in alignment with said via.

46. The substrate of claim 45, further including a second metal layer overlying said second surface, said second metal layer including an opening in alignment with said via.

47. The substrate of claim 46, wherein the opening in said first metal layer is larger than the opening in said second metal layer.

48. The substrate of claim 46, wherein said substrate includes a plurality of vias and a corresponding plurality of openings in said first and second metal layers.

49. The substrate of claim 41, wherein said dihydric alcohol and said water are present in a ratio of from about 0.5:1 to about 8.5:1.

50. The substrate of claim 41, wherein said dihydric alcohol comprises glycol and said hydroxide comprises potassium hydroxide.

51. A polymer substrate having at least one via formed therein, said via formed by exposing a portion of said substrate to an etchant composition at a temperature in the range of from about 170° to about 230°F, said composition comprising glycol, potassium hydroxide and deionized water, wherein said glycol and said water are present in a ratio of from about 0.5:1 to about 8.5:1 and said potassium hydroxide is present in an amount of from about 40 to about 80 grams per 100 ml of glycol and water solution, and continuing said exposing step until a portion of said composition covering said via changes color.

52. The substrate of claim 51, further including a plurality of vias formed within said substrate.

53. The substrate of claim 52, wherein at least one of said vias has a diameter of about 100 microns or less.

54. The substrate of claim 51, wherein said substrate comprises a polyimide substrate.

55. The substrate of claim 51, wherein said substrate includes opposing first and second surfaces, and a first metal layer overlying said first surface, said first metal layer including an opening in alignment with said via.

56. The substrate of claim 55, further including a second metal layer overlying said second surface, said second metal layer including an opening in alignment with said via.

57. The substrate of claim 56, wherein the opening in said first metal layer is larger than the opening in said second metal layer.

58. The substrate of claim 56, wherein said substrate includes a plurality of vias and a corresponding plurality of openings in said first and second metal layers.

59. The substrate of claim 51, wherein said dihydric alcohol and said water are present in a ratio of from about 0.5:1 to about 8.5:1.

60. The substrate of claim 51, wherein said dihydric alcohol comprises glycol and said hydroxide comprises potassium hydroxide.

61. A package comprising in combination a polymer substrate in accordance with claim 41 and a microelectronic device having at least one metal ball thereon received within said via.

62. The package of claim 61, wherein said via has a diameter of about 100 microns or less.

63. The package of claim 61, wherein said substrate includes opposing first and second surfaces, and a first metal layer overlying said first surface, said first metal layer including an opening in alignment with said via.

64. The package of claim 63, further including a second metal layer overlying said second surface, said second metal layer including an opening in alignment with said via.

65. The package of claim 64, wherein the opening in said first metal layer is larger than the opening in said second metal layer.

66. The package of claim 64, wherein said substrate includes a plurality of vias and a corresponding plurality of openings in said first and second metal layers.

67. A package comprising in combination a polymer substrate in accordance with claim 51 and a microelectronic device having at least one metal ball thereon received within said via.

68. The package of claim 67, wherein said via has a diameter of about 100 microns or less.

69. The package of claim 67, wherein said substrate includes opposing first and second surfaces, and a first metal layer overlying said first surface, said first metal layer including an opening in alignment with said via.

70. The package of claim 69, further including a second metal layer overlying said second surface, said second metal layer including an opening in alignment with said via.

71. The package of claim 70, wherein the opening in said first metal layer is larger than the opening in said second metal layer.

72. The package of claim 70, wherein said substrate includes a plurality of vias and a corresponding plurality of openings in said first and second metal layers.